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CONFIDENTIAL PURSUANT TO COURT ORDER

**REPORT OF THE SEGAL GROUP
TO SPECIAL MASTER PERRY GOLKIN**

In re: National Football League Players' Concussion Injury Litigation, MDL 2323

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MDL 2323

I. INTRODUCTION AND QUALIFICATIONS

A. Assignment

1. The National Football League and NFL Properties LLC (the “NFL Parties”) have retained The Segal Group (“Segal”) to provide an expert opinion and documentation to the Special Master, Perry Golkin, regarding the monetary sufficiency of the \$760 million proposed class action settlement between the NFL Parties, the plaintiffs, and the proposed plaintiff class (the “Settlement”), in accordance with this Court’s January 14, 2014 Order denying, without prejudice, plaintiffs’ Motion for Preliminary Approval and Class Certification (the “Preliminary Approval Order”).

2. The Preliminary Approval Order directed the parties “to share the documentation referred to in their submissions with the Court through the Special Master.” (Preliminary Approval Order at 12.) We were retained to provide such documentation and related analyses, which assess the monetary sufficiency of two specific aspects of the proposed Settlement: the Monetary Award Fund (“MAF”) and the Baseline Assessment Program (“BAP”), each of which is described in the January 6, 2014 Settlement Agreement (the “Settlement Agreement”).¹

3. In Section II of this Report, we summarize our conclusions. In Section III, we describe the development of our actuarial model and the methodology we

¹ The Segal Group also served as consultants to counsel to the NFL Parties during the course of negotiations of the Settlement Agreement. The model used for the analysis described in this Report was developed in connection with that prior consulting work.

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used in evaluating the monetary sufficiency of the Settlement. In Section IV, we set forth our results, including: prevalence projections, evaluation of the net present value (“NPV”) of the fund necessary to compensate all eligible players and derivative claimants under the Settlement, analysis of the sufficiency of the BAP, and a cash flow analysis. In Section V, we set forth our final conclusions regarding the monetary sufficiency of the proposed Settlement.

B. Qualifications and Roles

4. Established in 1939, Segal is a leading employee benefits, actuarial, and human resources consulting firm with approximately 1,100 employees in 23 offices throughout the U.S. and Canada. For 75 years, Segal has been involved in developing health and retirement programs that meet the needs of employees, plan members, and plan sponsors. Segal’s work includes assessing and managing pension funding risk, valuing retirement and retiree health benefits promised to participants, providing consulting services to employers and other plan sponsors regarding management of the health status of plan participants, and providing consulting services to employers and other plan sponsors regarding selection of investment managers for retirement funds. Segal regularly assists large employers² in assessing the risks associated with their health and welfare benefit plans, projects future costs of these plans, and uses actuarial modeling to properly set budgets for these benefits.

5. Howard Fluhr, the lead author of this Report, is currently the Chairman of Segal, a position he has held since 2006, after serving twelve years as

² Segal has been engaged by the NFL in several of these capacities in the past, including assessments of player disability plans and the NFL coaches’ health plan, design and support of the League’s officiating performance program, as well as stochastic asset liability modeling for the NFL’s pension plan.

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President and Chief Executive Officer. He has been a member of Segal's Board of Directors since 1987.

6. Mr. Fluhr is a *cum laude* graduate of New York University, where he earned a bachelor's degree in Mathematics and Philosophy. He is a Fellow of the Society of Actuaries, a Fellow of the Conference of Consulting Actuaries, a Fellow of the Canadian Institute of Actuaries, a Member of the American Academy of Actuaries and the International Actuarial Association, as well as an Enrolled Actuary.

7. Mr. Fluhr has been practicing actuarial science for 50 years. Over that time, he has overseen scores of actuarial analyses and studies related to both health and retirement benefits.

8. Mr. Fluhr has further served as a consultant to both public and privately held organizations on retirement and health benefits topics, as well as on total compensation and human resource strategies. His current and past roles include:

- Member of the Board of Directors of the American Academy of Actuaries for six years and service as vice president of its pension council;
- Member of the Board of Directors for six years and served as a vice president of the Conference of Consulting Actuaries;
- Member of the Board of Trustees of the Employee Benefit Research Institute (EBRI) and previous Chairman of the Board;
- Trustee of the Committee for Economic Development (CED);
- Senior Fellow at the Jefferson School of Health Population;
- Member of The Economic Club of New York;
- Member of the National Academy of Social Insurance; and
- Member of the Dean's Advisory Council of the College of Arts and Sciences of New York University.

9. Mr. Fluhr has spoken before numerous professional and industry groups, including the Society of Actuaries, the American Academy of Actuaries, the

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Enrolled Actuaries Meeting, the International Foundation of Employee Benefit Plans, and The National Academy of Social Insurance. He has testified before a Presidential Commission on public policy issues related to retirement. He has been a guest instructor for graduate level courses at the Columbia Business School and the Harvard Business School, and he is the author of numerous articles on human resource and employee benefits issues.

10. Christopher Calvert, another member of the Segal team for this project, is a Senior Vice President at Segal with over 25 years of experience working in the healthcare industry. Mr. Calvert leads Segal's Corporate Health Practice and is responsible for delivery of health benefits services to dozens of clients. In this role, he oversees underwriting processes to assist his clients in assessing healthcare risk and cost. He received his Bachelor of Science in Consumer Economics from Cornell University and an MBA in Healthcare Administration from Baruch College/Mount Sinai Medical Center. Here, Mr. Calvert served as the project leader.

11. Howard Atkinson, a third member of the Segal team, has served as a Consultant and Health Actuary for Segal since 2005 and has worked in the healthcare actuarial field for over 35 years. He is an expert in the field of healthcare analysis, and his experience includes running cost projections, pricing plan provisions, risk analyses, reserve calculations and pricing and negotiating provider reimbursement levels. He is an Associate of the Society of Actuaries, a Member of the American Academy of Actuaries and a Fellow of the Conference of Consulting Actuaries. Mr. Atkinson was one of seven actuaries selected nationwide to serve as a Consultant to President Clinton's Health Care Reform Task Force to review the cost of the proposed Standard Benefits Plan. He

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received a Bachelor of Arts in Mathematics from Lincoln University. Mr. Atkinson served as the lead health actuary on this project.

12. Menachem Braun, a fourth member of the Segal team, has served as a Health and Retirement Actuary for Segal since 2008. His expertise includes retiree healthcare and pensions, including long-term projections, cash flow analyses, and assessment of the funding adequacy of retirement benefit plans and programs. He is an Associate of the Society of Actuaries, a Member of the American Academy of Actuaries and an Enrolled Actuary. He received a Bachelor of Arts in Mathematics from Yeshiva University, graduating *cum laude*. Mr. Braun served as the lead life actuary on this project.

13. Thomas D. Levy is a Senior Vice President and has been Segal's Chief Actuary since 1987. He has over 40 years of actuarial consulting experience. Mr. Levy coordinates all professional actuarial activities within the company, including the delivery of actuarial client services. He has overall responsibility for Segal's Actuarial Practice and chairs its Actuarial Managers' Committee. Mr. Levy has served as an expert in many litigations, including the *Agent Orange* litigation, in which he oversaw the design of, and helped calculate benefit-level determinations for, cash payments to eligible veterans and their survivors. Mr. Levy received a BA and a Master of Actuarial Science degree from the University of Michigan. He is a Fellow of the Society of Actuaries, a Member of the American Academy of Actuaries, a Fellow of the Conference of Consulting Actuaries, an Enrolled Actuary, a Fellow of the Canadian Institute of Actuaries, and an Associate of the (British) Institute of Actuaries. Mr. Levy peer-reviewed this Report.

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II. SUMMARY OF CONCLUSIONS

14. On January 6, 2014, the NFL Parties and the Class and Subclass Representatives on behalf of a proposed Settlement Class (together, the “Parties”), entered into a proposed Settlement Agreement under which the NFL Parties agreed to pay \$760 million (the “Settlement Amount”)³ into three funds over the course of a twenty-year period to settle, among other things, the claims made in *In re: National Football League Players' Concussion Injury Litigation*, MDL 2323 (“MDL 2323”). The Settlement Agreement provides that the NFL Parties will pay \$675 million into the MAF, which is designed to make cash payments to eligible retired NFL players who develop conditions consistent with serious cognitive impairment. Those conditions include dementia (both mild and moderate), Alzheimer’s disease, Parkinson’s disease, amyotrophic lateral sclerosis (“ALS”), and, in some instances, chronic traumatic encephalopathy (“CTE”) (collectively, the “Qualifying Diagnoses”). The MAF is designed to last 65 years. In the event the Settlement Amount is insufficient to pay all approved claims from the MAF, the NFL Parties have agreed to make an additional contribution of up to a maximum of \$37.5 million, subject to court approval. The Settlement Agreement further contemplates that the NFL Parties will pay an additional \$75 million into a Baseline Assessment Program (“BAP”) that serves two purposes: (a) to provide baseline medical examinations to eligible retired NFL players; and (b) for those players diagnosed with Level 1 cognitive impairment, *i.e.*, moderate cognitive impairment, to provide further testing and treatment. The BAP is designed to last ten years for testing and an additional five years to provide treatment. At the expiration of

³ Unless otherwise stated, the capitalized terms used in this Report have the same meanings as those used in the Settlement Agreement.

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the BAP term, any remaining funds out of the \$75 million will roll over into the MAF. Finally, the Settlement Agreement creates an Education Fund designed to provide safety-related education to football players, including youth football players. The NFL Parties will pay \$10 million into the Education Fund. We note that the Education Fund does not affect the amount available for the MAF or the BAP and therefore did not factor into our analysis of the sufficiency of the overall proposed Settlement.

15. In order to evaluate the sufficiency of the proposed Settlement, we developed an actuarial model designed to project the prevalence of the Qualifying Diagnoses over the proposed 65-year term of the Settlement within the entire proposed class of retired NFL players who develop Qualifying Diagnoses at any point during the term of the Settlement and the associated monetary awards to those players and their derivative claimants.⁴ We of course cannot project with absolute certainty how many players, which players, and when such players will develop Qualifying Diagnoses at specific ages over the next 65 years. The science of making such projections is the core focus of actuarial science. We built a model in which we utilized conservative assumptions within a reasonable range based on the best possible data.⁵ In developing our assumptions, we at each stage sought to err on the side of overstating the number of players who will develop Qualifying Diagnoses and also sought to err on the side of projecting the development of the Qualifying Diagnoses at earlier ages. We did so in

⁴ We did not account separately for payments to Derivative Claimants because the Settlement Agreement provides that those payments are already included within the calculation of the monetary awards to qualifying retired players.

⁵ At all times, we followed actuarial standards of practice in developing our assumptions. See, e.g., M. Oliver, *Assessment and Selection of Actuarial Assumptions for Measuring Pension Obligations* (2009), available at <http://www.soa.org/files/pdf/edu-2009-fall-ea-assess-sn.pdf>.

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order to better test the sufficiency of the fund. This conservative approach increases the confidence in our conclusions regarding the sufficiency of the fund.

16. Our model was built in the following steps. First, we created a database of the approximately 20,500 players in the proposed class of retired NFL players and collected all available relevant information regarding those players, such as number of seasons played and current ages of those players. We obtained credited seasons and age information from the NFL. Second, we received a sample data set from Co-Lead Counsel for the Plaintiffs identifying the current cognitive impairment, or lack thereof, for approximately 1,500 plaintiffs in MDL 2323. We used that cognitive impairment information to determine the number of Qualifying Diagnoses, or the “prevalence rate,” within the population of 1,500 plaintiffs. We then used those prevalence rates within the population of 1,500 plaintiffs to project the current prevalence of Qualifying Diagnoses within the approximately 19,000 remaining players in the proposed class, from which we derived an initial prevalence rate across those 19,000 retired players. Finally, we modeled the progression over time of the Qualifying Diagnoses within the entire population of 20,500 players to project the total prevalence rates over the entire class population for the 65-year term of the Settlement.

17. The Settlement Agreement provides that monetary awards paid in future years will be subject to an annual inflation adjustment of up to 2.50%, the precise amount each year to be determined by the Court or the Special Master. The Settlement Agreement also provides that the NFL Parties will fund the Settlement over a twenty-year period based on a payment schedule set forth in the Settlement Agreement. Because of these two aspects of the Settlement, it was necessary to: (a) adjust upward the size of the

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awards in nominal dollars going forward based on projected inflation, and (b) calculate the expected present value of future contributions and awards in order to reflect the time value of money to evaluate the adequacy of the settlement funding at the present time. Our assumptions regarding the appropriate discount (4.50%) and inflation (2.0%) rates that we used are described in this Report.

18. In order to develop our projections, we made a series of informed, reasonable, and conservative assumptions about various factors provided for in the proposed Settlement, which are described below. In designing our model, we attempted to build in a margin of error such that there is a greater likelihood that we are overestimating, rather than underestimating, both the prevalence of Qualifying Diagnoses that will occur within the population of retired NFL players who participate in the Settlement and the monetary awards associated with those prevalence projections. In other words, our goal was to project more monetary payments at higher values to retired players than we would otherwise expect to occur over the term of the Settlement. For these reasons, we consider our approach to be a conservative one that may well overestimate both the number of players that actually will suffer from the Qualifying Diagnoses defined in the Settlement Agreement and the ages at which such players will be affected by such conditions. The overall methodology used to develop this model was based on well-established and accepted methods and approaches in the field of actuarial science that are commonly employed in forecasting and modeling health and benefit plans.

19. **Based on the model utilized by our team and the conservative assumptions detailed in this Report, we are confident that the \$760 million proposed**

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Settlement is sufficient to fund the expected monetary awards and BAP benefits to eligible and qualified participating class members over the life of the program and to pay the required administrative costs.

20. Specifically:

(a) The \$75 million BAP Fund is sufficiently funded. Indeed, based on the assumptions detailed within this Report and the funding requirements during the term of the BAP, we expect that there will be an \$11 million surplus on a net present value basis available that will rollover into the MAF at the conclusion of the BAP. Details of our calculations are provided further in this Report.

(b) The Settlement Agreement includes a Monetary Award Grid (the “Grid”) that sets forth the maximum monetary award for eligible and qualified class members based on their Qualified Diagnosis and age. We project that monetary awards with an actual dollar payout of approximately \$900 million will be paid out to eligible retired NFL players over the life of the Settlement. This \$900 million in awards has a net present value of approximately \$537 million.

(c) The NPV of the \$675 million fund to be paid into the MAF over twenty years—after removing \$10 million for administration of the awards—is \$533 million. After accounting for the \$11 million rollover from the BAP, we project a \$7 million cushion for the monetary awards that we forecast will be paid over the life of the MAF, *without touching the \$37.5 million contingency fund.*

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(d) As noted, based on our projections, we do not anticipate that any portion of the \$37.5 million contingency fund will be triggered under Section 23.4 of the Settlement Agreement. (Section 23.4 provides that the NFL Parties will contribute an additional contingent contribution of up to a maximum amount of \$37.5 million in the event the \$675 million dedicated to the MAF becomes insufficient at any time during the term of the Settlement).

(e) Based on our conservative assumptions, and given the existence of the \$37.5 million contingency fund, we are confident that the overall funding of the MAF is sufficient to cover the anticipated payouts to class members.

III. DEVELOPMENT OF MODEL AND METHODOLOGY

A. Overall Design of Model & Assumptions

21. Actuaries are tasked with forecasting unknown events over extended periods of time. Here, we have been asked to forecast the prevalence of various Qualifying Diagnoses for a group of retired NFL players over the next 65 years. In doing so, we relied upon the best available data and made reasonable, informed and conservative decisions about the necessary assumptions required to create our actuarial model.

22. Our model is designed to project the prevalence of each Qualifying Diagnosis across the class of retired NFL players throughout the 65-year term of the Settlement. The model runs those prevalence projections against the Grid agreed to by the Parties as part of the Settlement Agreement. The Grid sets forth the baseline awards for each Qualifying Diagnosis based on the retired NFL football player's age at diagnosis. Applying the Qualifying Diagnosis prevalence projections against the Grid

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determines the nominal value of the likely awards over the life of the Settlement based on a series of assumptions about the rates of prevalence of the Qualifying Diagnoses and the ages at which players are likely to develop those Qualifying Diagnoses and when payouts will be made. The model further incorporates the Offsets agreed to by the Parties and addressed in the Settlement Agreement that result in reductions to the baseline monetary awards outlined in the Grid. These Offsets are applied for the following factors: fewer than five Eligible Seasons played, a prior stroke, a prior traumatic brain injury, and non-participation in the BAP. These Offsets are applied in a multiplicative manner pursuant to the terms of the Settlement Agreement. In other words, if two Offsets of 25% apply, rather than adding them and applying a 50% Offset to the award, we multiply the 25% Offsets and apply a 43.75% Offset to the award. After all expected awards are projected over time, we calculated the value in today's dollars of all of the future payouts using an appropriate discount rate.

23. We made a series of assumptions that work together to generate the prevalence and NPV calculations. As discussed in more detail below, we made assumptions regarding: (a) sample data prevalence rates, (b) age at diagnosis, (c) progression of diagnoses, (d) participation rates in the Settlement, (e) inflation/discount rates, and (f) the frequency of the Offsets agreed to in the Settlement Agreement. We formulated these assumptions by relying on a variety of sources, including, but not limited to, a review of epidemiological studies regarding the incidence and prevalence of the Qualifying Diagnoses within the general population and the population of retired NFL players as well as discussions with a neurologist and epidemiologist, Dr. Kristine Yaffe.⁶

⁶ Dr. Kristine Yaffe is a medical consultant retained on behalf of the NFL Parties. She is a Professor in the Departments of Psychiatry, Neurology and Epidemiology at the University of California San

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The list of epidemiological studies we reviewed and relied upon is attached in Appendix A to this Report. As noted above, consistent with our overall approach, we focused on developing assumptions that are conservative, both individually and in aggregate. The results of our assumptions, when combined with the known parameters within the model, indicate that 33% of plaintiffs and 28% of the overall player population are expected to develop a Qualifying Diagnosis in their lifetime. Thus, our assumptions result in prevalence rates by age group that are materially higher than those expected in the general population. Furthermore, the model forecasts that players will develop these diagnoses at notably younger ages than the general population.

24. The chart below compares our projected prevalence rates of dementia and Alzheimer's in the overall population of retired players that we anticipate will participate to prevalence rates in the general population. These results support the statement above that our model assumes that more players will have a Qualifying Diagnosis than seen in the general population, and that these diagnoses will occur at significantly younger ages. It is important to note that the chart shows age at onset of final Qualifying Diagnoses of Alzheimer's or Level 2 dementia for each participating player, and thus does not account for the fact that our model also assumes that the players will develop Level 1.5 dementia at even earlier ages than represented in this chart. As the chart below demonstrates, at all age bands, the prevalence rates of Alzheimer's and dementia in the participating player population generated by our model after all of our assumptions are applied—which account for approximately 90% of projected Qualifying

Francisco ("UCSF"). Dr. Yaffe is trained in neurology and psychiatry and has a clinical practice in those areas at UCSF. She is also the Director of the UCSF Dementia Epidemiology Research Group, which conducts research relating to cognitive function and dementia in aging populations throughout the United States, and the Chief of Geriatric Psychiatry and Director of the Memory Disorders Clinic at the San Francisco VA Medical Center.

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Diagnoses—are consistently significantly higher than the corresponding prevalence rates in the general population.

Age Group	Segal Model Results - Prevalence of Alzheimer's and Dementia in Participating Player Population ⁷	Epidemiology on General Population ⁸
less than 50	0.8%	<0.1% ⁹
50-54	1.4%	<0.1%
55-59	2.3%	<0.1%
60-64	3.5%	<0.1% - 1.3%
65-69	5.2%	<0.1% - 2.1%
70-74	7.8%	2.8% - 3.7%
75-79	12.1%	4.9% - 6.8%
80-84	22.2%	12.3% - 13.0%
85-89	58.2%	20.3% - 21.6%
90+	n/a	38.5% - 45.2%

B. Database of Retired NFL Football Players

25. Our team first developed a database of identifiable retired NFL football players using information we obtained from the NFL and other public sources. We believe this database represents virtually all of the proposed class of retired NFL players.¹⁰ This database is being provided to the Special Master.

⁷ These results are based on the assumptions described in this Report.

⁸ Findings are based on studies by Hurd, *et al.* (2013), Pierce, *et al.* (2013), and Plassman, *et al.* (2007).

⁹ We were unable to identify prevalence rates for Alzheimer's and dementia in the general population for ages below 60. We have used "<0.1%" to note that the prevalence rates for these conditions are very low based on the lack of epidemiology in this area. We note that the rates between ages 60 and 70 range between <0.1 and 2.1%, and are lower below age 60.

¹⁰ We note that players who participated in training camps of NFL teams but did not make any roster are included in the proposed class. We do not have sufficient information to individually identify the members of this group, but as explained below in footnote 21, we have determined that this unknown group of players will not have a material impact on our analyses or conclusions.

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26. The database includes information about approximately 20,500 retired NFL football players in the following two groups: (a) 18,919 living retired players of whom 4,808 are plaintiffs; and (b) 1,642 deceased retired players of whom 77 are plaintiffs. Within these groups, certain relevant parameters were known about the players while others were not, as reflected in the following chart:

Known Parameters	Unknown Parameters
Date of birth	Level of cognitive impairment (certain class members)
Date of death	Age at diagnosis (certain class members)
Credited seasons	Participation in Settlement and exams
Seasons played in NFL ¹¹	Traumatic brain injury from non-NFL incident
Plaintiff/non-plaintiff and date of lawsuit	Stroke
Level of cognitive impairment (certain class members)	
Age at first diagnosis (certain class members)	

C. Plaintiffs' Sample Data File

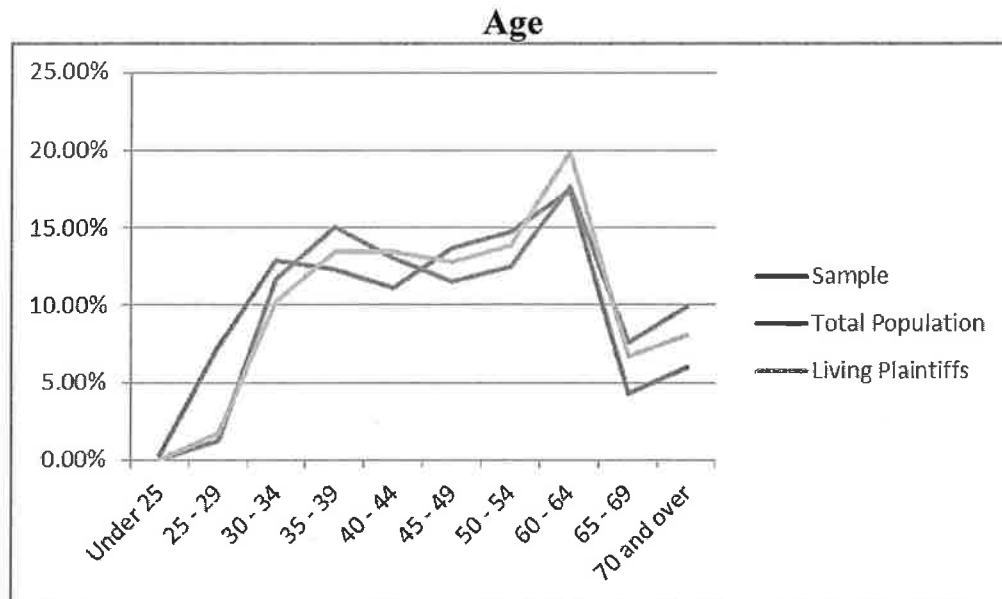
27. In addition, the plaintiffs in MDL 2323 provided us with a data file containing certain demographic information for 2,179 former players, of whom 1,584 former players provided information regarding their level of cognitive impairment/diagnosis of conditions. This database also is being provided to the Special Master.

¹¹ The NFL provided us with information regarding the number of Credited Seasons for the approximately 20,500 players in our database. Although the definition of Eligible Seasons in the Settlement Agreement is not identical to the definition of Credited Seasons used in various NFL plans, including its pension plan, the Credited Seasons data served as a reliable proxy for Eligible Seasons and allowed us to project accurately the Eligible Seasons Offsets agreed to in the Settlement Agreement. A chart reflecting the number of players at each level of Credited Seasons is included below in paragraph 41(a) of this Report. Moreover, the Credited Seasons data for each individual player is included in our database of approximately 20,500 players which has been provided in electronic format to the Special Master.

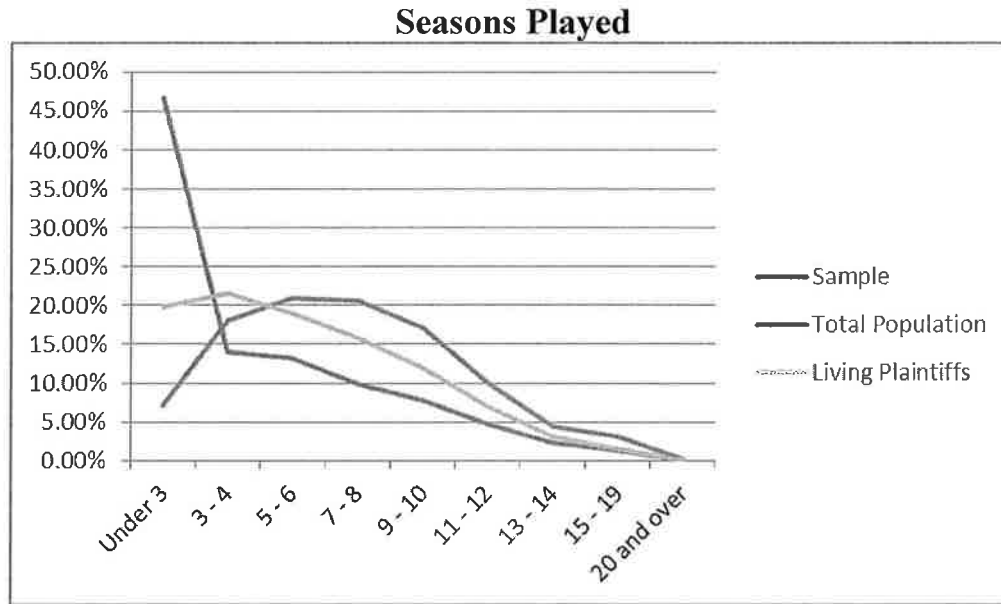
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28. Upon receiving plaintiffs' sample player data file, we first assessed whether the sample group was representative of the more than 20,500 retired NFL players in our database by comparing the ages and number of seasons played of players in the two groups. We determined that plaintiffs' sample group was representative of the larger group with respect to age; however, with respect to seasons played, the sample group contained proportionally more veteran players, *i.e.*, more players who played more seasons in the NFL than the overall proposed class of retired NFL players. This distinction between the sample group and the larger database was taken into account in determining how appropriately to extrapolate the prevalence rates of the sample group to the remaining approximately 19,000 players in our database of retired NFL players, as discussed in more detail below.

29. Graphs demonstrating the results of our analysis of the representative nature of the sample group are provided below.



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30. Because the sample data file was statistically representative of the overall class of retired NFL players in terms of age and seasons played (after adjusting for the higher proportion of veterans in the sample), we used that data as the starting point for our assumptions (discussed below) and prevalence projections of Qualifying Diagnoses and to determine the amount of money necessary to fund the Settlement. However, after reviewing the prevalence rates (and ages of diagnosis) from the sample data, we believe that the plaintiffs who make up the sample data file, as a result of having chosen to initiate a lawsuit against the NFL Parties and having provided data regarding their cognitive impairment, are more likely to have a current Qualifying Diagnosis than other retired players who have not initiated lawsuits or have not provided such cognitive impairment information. We hold this view because it is likely that players who are currently suffering from cognitive impairment, particularly at the level of dementia or above, were more likely to file a lawsuit against the NFL Parties than players who are currently asymptomatic. Similarly, it is likely that players who currently suffer from cognitive impairment at the level of dementia or above were more likely than

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asymptomatic players to report those conditions to their counsel through the sample data collection process. Thus, we adjusted for the greater likelihood that players in plaintiffs' sample data set suffered from cognitive impairment as compared to those outside that data set. We believe this adjustment was necessary to ensure the accuracy of our model. We describe this adjustment below (*see* ¶ 41(a)) in our discussion of Sample Data Rates.

D. Analyzing Plaintiffs' Data Set

31. Once we obtained the sample data set from the plaintiffs, we sought to determine the current level of cognitive impairment within that population of approximately 1,500 players for whom we had such data. As described below, once we determined the current prevalence rates of the Qualifying Diagnoses within the sample group of 1,500 players, we used those prevalence rates to project the prevalence rates of the Qualifying Diagnoses within the remaining 19,000 players.

32. The diagnostic information reported by plaintiffs in the sample data file was not identical to the Qualifying Diagnoses in the Settlement Agreement. Rather, it is our understanding that the former players completed an online survey identifying their diagnoses, conditions or symptoms and specifying whether such diagnoses, conditions or symptoms were self-reported or diagnosed by a physician. A screenshot of the diagnoses/symptoms provided to us by plaintiffs is being provided to the Special Master. Because the diagnoses/symptoms were not identical to the definitions for the Qualifying Diagnoses, we were required to make a series of assumptions about the sample group depending on how many symptoms they suffered from and whether those symptoms were diagnosed or self-reported. Those assumptions were as follows:

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**Classification of Plaintiffs' Data Sample
Based on Plaintiff Award Definitions**

Most Severe Condition Reported	Count	None/ Level 1	Level 1.5	Level 2 ¹²	ALS	CTE
ALS	9				9	
Parkinson's	5			5		
Dementia	58			58		
Alzheimer's	29			29		
9 or more diagnosed deficits	42	21	21			
8 diagnosed deficits	21	10.5	10.5			
7 diagnosed deficits	41	41				
6 diagnosed deficits	32	32				
5 diagnosed deficits	45	45				
4 diagnosed deficits	67	67				
3 diagnosed deficits	58	58				
9 or more self-reported deficits	130	130				
8 self-reported deficits	77	77				
7 self-reported deficits	90	90				
6 self-reported deficits	94	94				
5 self-reported deficits	128	128				
4 self-reported deficits	159	159				
3 self-reported deficits	182	182				
Neuro-Cognitive diagnosed	69	34.5	34.5			
Neuro-Cognitive self-reported	248	248				
CTE	8					8
Total	1592	1417	66	92	9	8

33. As shown in the chart, for players who reported diagnoses of dementia, Alzheimer's, Parkinson's, ALS, or CTE, we assumed that they, in fact, currently have dementia (Level 2), Alzheimer's, Parkinson's, ALS, or CTE. In other words, we fully credited reports of diagnoses of the Qualifying Conditions.

34. We also had to determine how to treat players who reported "symptoms" included in plaintiffs' database, with or without any formal diagnosis. In general, if a player reported a large number of diagnosed symptoms (8 or more), we

¹² Includes Level 2, Parkinson's and Alzheimer's as appropriate.

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assumed, for purposes of the model, that 50% of those players were in Level 1.5, *i.e.*, mild dementia—again, a reasonable and conservative assumption in our view given that those players did not identify themselves as diagnosed with dementia. The remaining 50% of those players were assumed not to have a Qualifying Diagnosis. This approach was reasonable and conservative as well in our view because: (a) many of the symptoms, such as headaches or sleeplessness, are common in the general population and do not, in fact, necessarily indicate mild dementia; (b) even symptoms that were reported to be “diagnosed” were in fact self-reported, *i.e.*, players were not required to provide medical records supporting any diagnosis, which gives us less confidence in their accuracy; and (c) some of the symptoms, such as memory loss and forgetfulness, were redundant, thereby increasing the likelihood that a player would report more symptoms. If a player reported that he had been diagnosed with fewer than eight symptoms or did not claim that his symptoms were diagnosed, we considered him asymptomatic. We did so because the lowest Qualifying Diagnosis is Level 1.5, or mild dementia; and we believe it is reasonable to assume that a player that took the time to bring a claim against the NFL Parties had every incentive to list all symptoms associated with mild dementia or to have reported a diagnosis of that condition if his condition could at all be construed as such.

35. Plaintiffs’ database also included a condition labeled as “Neuro-Cognitive diagnosed” or “Neuro-Cognitive self-reported.” This condition was not defined. For those players who said that they were “Neuro-Cognitive diagnosed,” we assumed that 50% of those players were in Level 1.5, *i.e.*, mild dementia—again, a reasonable and conservative assumption in our view, given that those players who identified themselves as “Neuro-cognitive diagnosed” did not identify themselves as

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diagnosed with dementia. The remaining 50% of those players were assumed to not have any Qualifying Diagnosis. For the same reasons that we did not apply a Qualifying Diagnosis to players who only self-reported symptoms (*see* ¶ 31, above), we assumed players who stated that they were “Neuro-cognitive self-reported” were asymptomatic.

E. Generating Prevalence Rates

36. Using the assumptions described above, we generated the prevalence rates for the sample group of approximately 1,500 players. Those prevalence rates were as follows: 4.1% of the sample group currently have a Qualifying Diagnosis of Level 1.5; 5.8% currently have a Qualifying Diagnosis of Level 2, Alzheimer’s Disease or Parkinson’s disease;¹³ 0.6% currently have a Qualifying Diagnosis of ALS; 0.5% currently qualify for death with CTE under the Settlement Agreement; and 89.0% of the plaintiffs in the sample data file do not have a current Qualifying Diagnosis.

37. We validated these prevalence rates of the Qualifying Diagnoses among the sample group against epidemiological studies focused on the general population and on retired NFL players. (*See* Appendix A.) We determined that the prevalence rates among the sample group were higher than the prevalence rates found in general population studies and even studies focused on professional football players. As discussed below, we used these higher prevalence rates in developing projections

¹³ Our review of medical literature and information provided by medical consultants informed us that epidemiologists and clinicians do not always distinguish between dementia and Alzheimer’s disease. In certain epidemiological studies, dementia is considered an umbrella condition that incorporates all forms of dementia, including Alzheimer’s. Our review of medical literature also informed us that the prevalence rates for Parkinson’s Disease in the general population are relatively low as compared to the rates of dementia and Alzheimer’s. Thus, when making our projections about which players statistically were likely to develop Level 2 dementia versus Alzheimer’s versus Parkinson’s, we used the following ratios for those conditions. We assumed 55% of players whose condition progressed to Level 2 independent of their starting point would become diagnosed with Alzheimer’s, 5% with Parkinson’s, and 40% with Level 2 dementia.

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regarding the prevalence of Qualifying Diagnoses within the 19,000 players for whom diagnoses are unknown.

38. As discussed above, the prevalence rates for the sample group became the basis for our projections of prevalence rates within the remaining approximately 19,000 players in our database. Before extrapolating the sample group data across our database of retired NFL players, however, we “hard-coded,” or locked in, the Qualifying Diagnoses for the sample group players who we believe today have a Qualifying Diagnosis of Level 2, Alzheimer’s Disease, Parkinson’s Disease, ALS, or CTE.¹⁴ Thus, when our model is run against the entire population of retired NFL players, it will always project that those players have the Qualifying Diagnoses they reported.¹⁵ For certain players in the sample data file, in addition to their symptoms or diagnoses, plaintiffs provided us with the date of diagnosis as well. In those instances, we also “hard-coded” the date of diagnosis so that we would know exactly where they fall on the Grid, which adjusts awards for age of diagnosis. For those players for whom the date of diagnosis was not provided, consistent with our conservative approach, we assumed the age of diagnosis was their age at January 1, 2013 and “hard-coded” their ages of diagnoses accordingly.

39. After developing initial prevalence rates for the 20,500 players in our database, we projected how prevalence rates would progress over the 65-year term of

¹⁴ We also obtained information we viewed as reliable regarding the conditions of certain non-plaintiffs from public sources. In particular, we identified players who reportedly have been diagnosed with ALS and/or CTE. In those instances, we also “hard-coded” their diagnoses in our database.

¹⁵ We hard-coded players in the sample group who reported that they were diagnosed with dementia in Level 2. However, specific players from the sample group who were assigned to Level 1.5 were not hard-coded with that diagnosis because they had not reported a diagnosis of dementia, but rather were assigned to mild dementia based on our assumptions about the sample data group. Thus, those players were randomly assigned to Level 1.5 or asymptomatic with a 50% probability.

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the Settlement as class members aged. After determining initial prevalence rates, we assumed that a certain number of asymptomatic players—whether plaintiffs or non-plaintiffs—would progress and develop dementia, Alzheimer's or Parkinson's disease over their lives and the Settlement term.

F. Assumptions

40. The model divided the class into four groups:

(a) Plaintiffs for whom specific diagnosis information is known based on the sample data (1,565 former players);

(b) Plaintiffs for whom specific diagnosis information is unknown (3,320 former players);

(c) Non-Plaintiffs for whom specific diagnosis information is known based on public research (80 former players); and

(d) Non-Plaintiffs for whom specific diagnosis information is unknown (15,596 former players).

41. We separately made the following assumptions:

(a) **Sample Data Rates.**

(i) In order to determine the initial prevalence rates for the remaining approximately 19,000 players in our database, we took the prevalence rates for the sample data group of approximately 1,500 players and applied them after adjusting to reflect lower overall assumed prevalence rates among the remaining 19,000 players. We did this for several reasons. First, as discussed above, the sample group contained proportionally more veteran players than the database of the entire proposed class

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of players. Second, as discussed above, we assumed that players with current cognitive impairment, particularly severe impairment, were more likely to have participated in the litigation and to have reported their symptoms and conditions in the database. The prevalence rates that we observed in the sample data group, when combined with the ages at which such diagnoses were occurring, were higher than prevalence rates not only in general population epidemiology, but also in epidemiology focused on professional football players. Both of these points indicate a strong selection bias in the sample data towards players with current cognitive impairment. As such, we reduced the prevalence rates used for the remaining 19,000 players when compared to the sample data by the following factors:

(ii) For plaintiffs who are not part of the sample group, we assumed prevalence rates of 50% of those rates identified in the sample data set. For example, 4.1% of the sample group plaintiffs were projected to have a current diagnosis of Level 1.5; we therefore projected that 2.1% of the remaining plaintiffs have a current diagnosis of Level 1.5. For non-plaintiffs, we assumed prevalence rates of 25% of those rates identified in the sample data for living non-plaintiffs and 12.5% of those rates for deceased non-plaintiffs. We applied the lowest prevalence rates to deceased non-plaintiffs because their conditions are static and we believe that the

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families of deceased players with Qualifying Diagnoses were more likely to initiate lawsuits than the families of deceased players without Qualifying Diagnoses. Thus, we expect fewer players with Qualifying Diagnoses in the deceased, non-plaintiff group as compared to living non-plaintiffs.

(iii) Described another way, it is likely that plaintiffs are more likely than non-plaintiffs to have Qualifying Diagnoses at the present time, and that plaintiffs who have the ability to establish their diagnosis have done so. Therefore, plaintiffs for whom we do not have a current diagnosis are given half the prevalence rates of those who have, and non-plaintiffs are given half the rate of undiagnosed plaintiffs. As discussed in detail below (*see* ¶ 34 below), our assumptions, including these sample data rate assumptions, were validated against the final results of the model, which gives us further confidence that the sample data rate assumptions are reasonable.

(iv) We believe these overall current prevalence results are consistent with the various epidemiological studies that we reviewed. We also discussed the reasonableness of these assumptions with Dr. Yaffe, who concurred that they were reasonable. A summary chart of the prevalence rates is below.

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Summary of Initial Prevalence Rates

	Sample Data	Remaining Population (no diagnosis information available)			
Cognitive Impairment	Observed Prevalence in Sample Group	Non-Deceased Plaintiff	Non-Deceased Non-Plaintiff	Deceased Plaintiffs ¹⁶	Deceased Non-Plaintiffs
None/Level 1	89.0%	94.7%	97.4%	0.0%	98.7%
Level 1.5	4.1%	2.1%	1.0%	39.5%	0.5%
Level 2 ¹⁷	5.8%	2.9%	1.5%	55.1%	0.7%
ALS	0.6%	0.3%	0.1%	5.4%	0.1%
CTE ¹⁸	0.5%	0.0%	0.0%	0.0%	0.0%

(b) **Initial age assignment.** For the same reasons that we adjusted the prevalence rates for the sample group, we also adjusted the initial age assignments of the sample group to reflect that the Qualifying Diagnoses would be diagnosed within the 19,000 players at somewhat later ages than the sample group. We did so based on epidemiological studies we reviewed that discuss prevalence of the diagnoses by age. As has been discussed, because plaintiffs—particularly those who provided diagnosis information—are more likely to have Qualifying Diagnoses, we assume a meaningful selection bias in the sample data set. This selection bias results in higher initial prevalence rates, particularly at younger ages. We, therefore, adjusted for this bias and made adjustments to the initial age results from the sample group. Our adjustments still result in a

¹⁶ There are only 32 deceased plaintiffs for whom we do not have diagnosis information. Of the 45 deceased plaintiffs for whom we have diagnosis information, 44 have a Qualifying Diagnosis based upon the information provided to us.

¹⁷ Includes Level 2, Alzheimer's and Parkinson's.

¹⁸ We have assumed that all players diagnosed with CTE (based on public information) will participate in the Settlement and claim monetary awards. Because the Settlement will not provide monetary awards for CTE for players diagnosed with CTE after the date of Preliminary Approval, the model assumes that no other players will be diagnosed with CTE.

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significantly higher prevalence in younger age groups than in the general population. As just one example, prevalence of dementia, Alzheimer's, and Parkinson's in the general population below age 50 is less than 1%. In fact, it is difficult to find a single study showing prevalence rates of those conditions below age 50 and the rates between ages 60 to 69, which are necessarily higher than the rates below age 60, range from <0.1 to 2.1%. By contrast, the prevalence rate in the sample group below age 50 is nearly 200 times that observed in the general population (based on a general population prevalence rate of 0.01%, which we believe is a reasonable estimate based on the lack of epidemiology related to the population below age 50). There is no medical literature suggesting a relative risk of anything close to that magnitude for football players or even non-football players who experience head trauma. Thus, for the 19,000 players that we project have a current Qualifying Diagnosis, we made a reasonable assumption resulting in a prevalence rate below age 50 for the overall class of retired players that is 35 times the general population rate. Thus, in making this assumption, we believe we are erring on the side of forecasting that players with current Qualifying Diagnoses will have those diagnoses at earlier ages (and thus receive higher monetary awards). This is consistent with the conservative approach we have taken in making our assumptions.

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Initial Age Distribution of Qualifying Diagnoses

Initial Age Distribution		
Ages	Observed Age in Sample Group for Qualifying Diagnoses	Assumed Distribution
49 & Younger	40%	2%
50 – 59	15%	15%
60 – 69	20%	35%
70 – 79	22%	38%
80 +	3%	10%

(c) **Progression.**

(i) In addition to determining current prevalence rates, we also made assumptions regarding progression rates over the 65-year term of the Settlement. Using the current prevalence rates of Qualifying Diagnoses across the entire class as a starting point, we projected how the conditions of players without a Qualifying Diagnosis (asymptomatic and Level 1) and players who have current diagnoses of Level 1.5 would progress over time. We believe our projection assumptions are consistent with the various epidemiological studies that we reviewed. We also discussed the reasonableness of these assumptions with Dr. Yaffe, who concurred that they were reasonable. Moreover, we validated the results of our progression assumptions by comparing the overall prevalence rates (by Qualifying Diagnosis and age) generated by the model against expectations in the general population based on

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the epidemiology we reviewed. Once again, our model results in higher prevalence rates at earlier ages than the general population.

(ii) The progression rates we used were as follows: 25% of players without a Qualifying Diagnosis (asymptomatic and Level 1) will develop a Qualifying Diagnosis other than Level 1.5, *i.e.*, Level 2, Alzheimer's, or Parkinson's; 1% of players without a Qualifying Diagnosis (asymptomatic and Level 1) will develop a Qualifying Diagnosis of Level 1.5 and progress no further;¹⁹ and 100% of participants with an initial diagnosis of Level 1.5 will progress to a Qualifying Diagnosis other than Level 1.5, *i.e.*, Level 2, Alzheimer's, or Parkinson's. Our 25% assumption is reasonable when compared to the expectation from general population epidemiology that less than 20% (approximately 17%) of the general population will develop dementia prior to death. Here, we assume 25% of the asymptomatic or Level 1 population alone will reach moderate or severe dementia prior to death, and are thus assuming that the retired players will develop these conditions at a rate of approximately 1.3 to 1.5 times the general population (depending on the study). We are further assuming that the retired players will develop the conditions at much earlier ages than the general population. We note that we also have assumed that 100%

¹⁹ We note that we have assumed that a small number of players (1%) without an initial Qualifying Diagnoses will progress to Level 1.5, but will not progress further to Level 2 because some players may die before progressing.

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of the players that we believe have a current diagnosis of Level 1.5 will progress to Level 2 within five years.

(iii) In addition, we randomly assigned ages for players that we project will develop Qualifying Diagnoses in the future between the current ages of players at the time of the Settlement Agreement and age 87. We used age 87 as the expected age of death based on current mortality tables.²⁰ We assumed that the progression would be weighted toward later ages based on our review of epidemiology, in which we see much higher prevalence rates at later ages in the general population. We used an actuarial technique to generate a distribution function to reflect the expected distribution of progression ages based on epidemiology. The table below illustrates the expected progression age for sample starting ages. We compared our final age distributions to epidemiology and determined that we were projecting the players to develop Qualifying Diagnoses at significantly earlier ages than those diagnoses occur within the general population, which further validated our approach. The general shape of the curve that we were looking to model can be found on page 84 of the article published by W. Rocca, *et al.*²¹ Our model produces a distribution curve that exhibits a similar concave, upward shape, but has higher

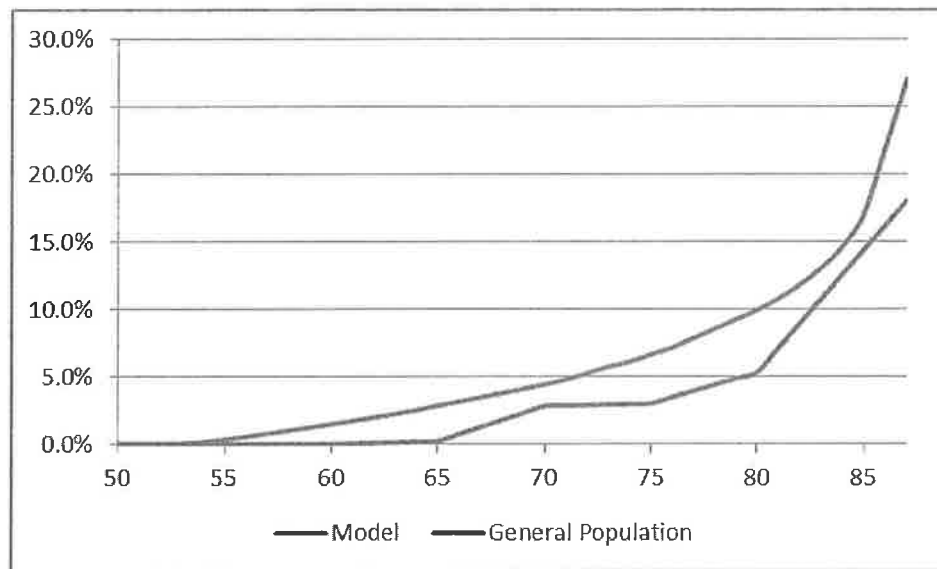
²⁰ See Appendix B for a discussion of the mortality tables used in our model and how they were applied within the model.

²¹ See Appendix A for additional details of this article.

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prevalence rates at younger ages and throughout. Our model is particularly conservative for ages prior to 65, where we are projecting rates that are 100 to 200 times higher than for the general population. These ages have larger payouts from the award grid. The graph below compares the prevalence rates produced as part of our progression modeling against prevalence rates for the general population.

Distribution of Expected Final Progression Ages for Retired NFL Population Compared to General Population



(iv) With respect to progression, we have considered that there may be future advances in medicine—including improved pharmaceutical therapies or even cures for one or more of the Qualifying Diagnoses—but have not made any adjustments to our model to account for that possibility. While it is reasonable to assume that advances will be made, the timing and effect of

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these advances are unknown. As such, we chose a conservative approach that assumed no improvement in the incidence or prevalence of the Qualifying Diagnoses over time.

(v) In addition, we considered adjustments to our model for future improvements that may impact mortality, but deemed that these improvements will not have a meaningful impact on overall awards due to the large offsets in the Grid at older ages, the time value of money given that the impact of any extended projected mortality will be far into the future, and the fact that we are evaluating monetary awards that will be paid to a closed group of former players with known current ages. Furthermore, the overall prevalence rates in our model far exceed current general population epidemiology. This result, combined with the fact that the Grid significantly reduces awards above age 80 (when later mortality would impact prevalence rates) indicates that no further adjustment for future changes in prevalence at advanced ages was appropriate.

(d) **Level 1.5 to Level 2.** For each player that we project will develop Level 2 in the future, we have assumed that he will first pass through Level 1.5 five years prior to his diagnosis of Level 2. This assumption was based on information provided to us by medical consultants regarding the progression from mild to moderate or severe dementia.

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(e) **Participation Rates in the Settlement.** We have assumed that 95% of plaintiffs and 50% of non-plaintiffs will participate in the Settlement based on discussion with and guidance from counsel. These assumptions result in over 60% of the total class of retired players participating in the Settlement. We consider these assumptions to be reasonable based on the discussion below. First, with respect to plaintiffs who have sought out counsel and filed a claim against the NFL Parties, we believe the vast majority of those players will remain in the Settlement and participate in the benefits available to them. Second, with respect to non-plaintiffs, based on a review of relevant literature, participation rates in class settlements generally range from 15 to 40%.²² Because the population of retired NFL players is well known, this litigation has been highly publicized, and we anticipate that every class member will receive actual notice and the payments for Qualifying Diagnoses potentially are significant, we expect that a materially higher percentage of class members will participate in this Settlement as compared to other class settlements. However, even though we assume a significantly greater participation in the Settlement than that reported for other

²² We have been provided with material indicating that fewer than one-third of class members generally participate in a class action settlement's claims process. This is consistent with the expert opinions accepted by a court in another major class action settlement in the Eastern District of Pennsylvania. There, the court cited expert opinions stating that "maximum participation in class settlement is historically 40%", and "the median historical participation rate in class action settlements is much lower, running at about 15%." *In re: Diet Drugs Prods. Liab. Litig.*, No. MDL 1203, 2001 WL 283163 (E.D. Pa. Mar. 21, 2001). We understand that these figures are also consistent with academic research. See Christopher R. Leslie, *The Significance of Silence: Collective Action Problems and Class Action Settlements*, 59 Fla. L. Rev. 71, 119-20 (2007) ("It is not unusual for only 10 or 15% of the class members to bother filing claims."); John C. Coffee Jr., *The Regulation of Entrepreneurial Litigation: Balancing Fairness and Efficiency in the Large Class Action*, 54 U. CHI. L. REV. 877, 920 n.107 (1987) ("Out of thirty class actions surveyed . . . in which class members had to file in order to receive benefits, only eight such actions had a response rate of 30 percent or more."); John C. Coffee, Jr., *Litigation Governance: Taking Accountability Seriously*, 110 Colum. L. Rev. 288, 334 (March 2010) (fewer "than thirty percent of the institutional investors in the securities class actions . . . filed claims after a settlement had been reached[.]").

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class settlements, we assume a 50% participation rate for non-plaintiffs because, among other reasons: (a) despite the widespread publicity surrounding this litigation, approximately only 25% of the class has decided to participate in the litigation by initiating a lawsuit; (b) some players may simply choose not to participate in the Settlement, either at the point of registration or when they become eligible for monetary awards; (c) some players may fail to register under the terms of the Settlement Agreement; and (d) some players may opt out of the Settlement.

(f) **Inflation Rate.** Because the monetary payouts are inflation-adjusted, we were required to make an assumption regarding the average inflation rate that will be applied on an annual basis over the 65-year term of the Settlement. The Parties agreed in the Settlement Agreement that the annual inflation factor may not exceed 2.50% and will be determined on an annual basis at the discretion of the Court or the Special Master. Given the likely volatility of the inflation rate over the 65-year period, we believe an assumed average rate of 2.00% is appropriate. Importantly, we anticipate that a significant portion of the total monetary awards will be paid out in the first three years of the Settlement term, which is highly likely to be a period of low inflation rates and also a short time horizon over which those inflation rates will be applied. We consulted an expert at Segal RogersCasey, Segal's investment consulting subsidiary, on this point. In determining the reasonableness of a 2.00% inflation assumption, he stochastically generated inflation rates over a 65-year time horizon, capping the annual rates at 2.50% as dictated by the Settlement Agreement. These rates were

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then applied to the expected Settlement payouts and under each iteration, a single rate was generated. The resulting rates were then averaged with a final average rate of 2.00%. These rates were generated using a proprietary model developed to reflect historical inflation rates with consideration of the current market as well as an outlook of future inflation.

(g) **Discount Rate.** Similarly, in determining the net present value of the Settlement, we made assumptions about the return that will be earned through conservative investments of the funding provided by the NFL Parties as well as an appropriate rate to apply to discount future values to present dollar values. Assuming a conservative investment portfolio comprised predominantly of municipal bonds, we have assumed a 4.5% rate of return that we project will be earned from the investment of the funds. We consulted an expert at Segal RogersCasey regarding this assumption, and he confirmed that it is a reasonable one.

42. We made the following assumptions about Offsets agreed to in the Settlement Agreement:

(a) **Eligible Seasons.** The Parties agreed in the Settlement to Offsets based on the number of Eligible Seasons earned by the retired NFL players. We have applied those Eligible Seasons Offsets and did not make any independent assumptions regarding those Offsets.

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Count of Retired Players by Credited Seasons

Service	Count
0	804
1	5,486
2	2,858
3	1,961
4	1,596
5	1,484
6	1,233
7	1,032
8	931
9	829
10+	2,340
Total	20,554

(b) **Age at diagnosis.** The Parties agreed to a Monetary Award Grid that makes adjustments to the monetary awards depending on the age at which players are diagnosed with the various Qualifying Diagnoses. We have applied that Grid based on the age data we had and assumptions we made (*see supra* ¶ []), and did not make any independent assumptions regarding the Grid.

(c) **Pre-2006 Decedents.** In Section 6.2 of the Settlement Agreement, the Parties agreed that the Representative Claimants of deceased Retired NFL Football Players who died before January 1, 2006 would be ineligible for monetary payouts unless the Court determines that a wrongful death or survival claim filed by the Representative Claimant would not be barred by the statute of limitations under applicable state law. Counsel instructed us to assume

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that 50% of pre-2006 decedents will be able to make such a showing with the Court and to assume that 50% of pre-2006 decedents will be ineligible for monetary awards through the MAF. We understand from counsel that this is a conservative assumption.

(d) **Stroke Offset.** The Parties agreed to a 75% Offset for players who are medically diagnosed with a stroke prior to their Qualifying Diagnoses. We applied that Offset without making any independent assumptions. However, we did make assumptions regarding the rate at which players will suffer strokes prior to their Qualifying Diagnoses. In order to do so, we reviewed relevant epidemiology. According to the Centers for Disease Control ("CDC"), the rate of stroke in the United States among people ages 65 or older was 8.3% in 2010 and increasing. Furthermore, the same data showed that the rate of stroke was slightly higher among males. This data led us to feel comfortable using an assumption of 9% for stroke among the NFL retired player population. However, the CDC does not provide data regarding the rate of stroke before dementia versus stroke after the onset of dementia, as the two comorbid conditions often occur in parallel. Thus we assumed that 50% of the time (or 4.5% overall) the stroke would occur after the onset of dementia and would not be subject to the 75% Offset.

(e) **Traumatic Brain Injury Offset.** The Parties agreed to a 75% Offset for players who are medically diagnosed with a traumatic brain injury ("TBI") prior to their Qualifying Diagnoses. We applied that Offset without making any independent assumptions. However, we did make assumptions

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regarding the rate at which players will suffer traumatic brain injuries prior to their Qualifying Diagnoses. According to the CDC, approximately 0.34% of the U.S. population suffers a traumatic brain injury each year. We then multiplied this by 35 years, which is the estimated average remaining years of life for retired players, to get a rate over that time of 12%. We then increased this rate by 17% because the same study found that males are 1.4 times more likely to have a stroke than females, for a rate of 14% throughout the remaining portion of their lifetime. We next reduced that by roughly half because the study's definition of TBI appears to be broader than the TBI definition in the Settlement agreement. Finally, because the CDC does not provide data as to the rate of TBI before dementia versus TBI after onset of dementia, we assumed that approximately 50% of the time (or 4% overall) the TBI would occur after the onset of dementia and not be subject to the 75% Offset.

(f) **Not participating in BAP.** The Parties agreed to a 10% Offset for certain players based on non-participation in the BAP, except where the Qualifying Diagnosis is of ALS or the player receives a Qualifying Diagnosis prior to his deadline to receive a baseline examination in the BAP. We applied that Offset without making any independent assumptions. Our assumption regarding the number of class members who will participate in the BAP is explained in paragraph 51 below.

G. Administrative Costs

43. Of the \$675 million dedicated to the MAF, we have assumed that \$10 million will be used for administrative costs based on rates provided to us by plaintiffs' counsel that were negotiated with the proposed Claims Administrator, Brown

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Greer. Thus, we have assumed that \$665 million is available for monetary awards over the term of the Settlement. We have assumed that the \$10 million will be paid out of the fund proportionally to the payout of the benefits. On a net present value basis, the \$10 million is determined to be worth \$6 million.

H. Stochastic Approach

44. After developing the assumptions described above, we randomly assigned them to individual players in the class using a stochastic approach. For example, we assumed that 95% of plaintiffs will participate in the Settlement. In applying this assumption, each individual plaintiff had a 95% chance of being deemed to have participated in the Settlement in each iteration of the model. We ran the model in 100 iterations and developed monetary projections to determine an average net present value of the payouts projected for the MAF.

45. In this case, the purpose of using a stochastic approach, which is a well-established statistical concept, is to run numerous iterations of the model to determine the expected value and the standard deviation of the expected payouts under the MAF. The approach provides us with a confidence interval surrounding the net present value results generated by the model, *i.e.*, a range of values in which we are 95% confident that the actual payouts under the MAF will fall. A stochastic approach is best practice in this instance because we cannot specifically apply the various assumptions described above to each specific player with certainty. *See generally* Clare Bellis *et al.*, *Understanding Actuarial Management: The Actuarial Control Cycle* 157-58 (1st ed. 2003). For example, if we only had ten players in our database and projected that one would develop Alzheimer's and another ALS, we could not determine which specific players would develop each condition, nor could we determine at what age each player

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would develop the disease. In this case, however, it would make a difference which two players developed the conditions, because different players played different amounts of time in the NFL and therefore are subject to varying Offsets. Moreover, for example, we would not know how many Eligible Seasons the Alzheimer's player had versus the ALS player, or whether the player will participate in the Settlement or the BAP. Finally, the age at which each condition is diagnosed impacts the monetary award to each player based on the tiered structure of the Grid. The stochastic approach allows us to apply the assumptions in an iterative manner that provides an educated forecast of the net present value and the confidence interval around that value based on our assumptions.

IV. RESULTS

A. Prevalence Projections and Net Present Value of Grid

46. As discussed above, under the stochastic approach we utilized in our model, we have averaged the prevalence projections generated by the model. Those final, averaged results showing incidence by age band and final prevalence are as follows:

Age Scatter of Final Incidence Projection

Age	Level 1.5	Level 2 ²³	ALS	CTE	Total
Under 45	3	54	5	9	71
45 - 49	4	54	2	1	61
50 - 54	2	72	2	10	86
55 - 59	4	114	2	4	124
60 - 64	6	152	4	3	165
65 - 69	8	189	3	5	205
70 - 74	8	262	8	6	284
75 - 79	13	347	4	5	369
80 +	77	2,036	1	9	2,123
Total Prevalence	125	3,280	31	52	3,488

²³ Includes Level 2, Alzheimer's and Parkinson's.

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47. These incidence/prevalence projections are for the 12,500 players that we assume will participate in the Settlement.

48. Significantly, our model projects that 33% of the current plaintiff population (*i.e.*, 4,808) and 28% of the total group of players we project will participate in the Settlement (*i.e.*, 12,500) have or will develop some Qualifying Diagnosis during the 65-year term of the Settlement. These results validate that our assumptions are reasonable and conservative because when compared to prevalence rates among the general population, they are significantly higher. Moreover, as anticipated, the model determines that players will first be diagnosed with various Qualifying Diagnoses at a younger age than the general population, which is consistent with plaintiffs' allegations.

49. We project that the MAF will be required to fund, on a net present value basis, \$537 million in payouts over the life of the Settlement. Aside from the \$37.5 million contingency fund, which will not have to be used, we expect that there will be \$544 million available from the settlement funds to finance these payouts on a net present value basis. The settlement funds consist of \$533 million from funding dedicated solely to the MAF, plus an \$11 million projected surplus from the BAP.²⁴ Our conclusions regarding the sufficiency of funding for the MAF and our confidence interval surrounding the variability of the net present value are discussed in greater detail below.

²⁴ In considering the impact of the unidentified group of retired players who participated in training camps for NFL teams, but did not make a formal roster, we looked at the players in our model who had zero Eligible Seasons (which is how training camp players would be treated under the Settlement Agreement). On average, those players received \$750 per player (the awards were higher but this per player figure includes players who were not projected to receive awards). Thus, we have concluded that "training camp only" players will not materially impact the sufficiency of the fund and do not alter our analysis or conclusions. And although we are unable to identify this group of players, it also seems less likely in our view that such players will participate in the Settlement given their limited careers in the NFL and limited exposure to head trauma during their NFL careers.

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B. Baseline Assessment Program

50. The Parties have allocated a \$75 million capped fund to the BAP ("BAP Fund") and have further agreed that any excess funds from the BAP Fund at the termination of the BAP will roll over into the MAF. We conducted an analysis of the BAP Fund to determine whether we expect any funds to rollover into the MAF.

51. We have assumed that 75% of participants in the settlement will undergo a baseline examination through the BAP. We based this assumption on the following factors. First, participation in the BAP is not mandatory to become eligible for a monetary award. Although some players will be subject to a 10% reduction in their monetary awards for lack of participation, players nevertheless would be eligible to receive awards simply by registering for the Settlement online within the agreed time period, even without participating in the BAP. Second, deceased players and players who currently have Qualifying Diagnoses need not participate in the BAP to receive their monetary awards. Third, some players in our database are ineligible to participate in the BAP based on the Settlement Agreement, which requires that a player have accrued at least half of an eligible season to participate in the BAP. Finally, younger, asymptomatic players may feel it is unnecessary to undergo neuropsychological and neurological testing if they are not exhibiting any signs of impairment today. Thus, players may not take advantage of the testing being provided under the Settlement even if they later choose to participate in the Settlement to become eligible for monetary awards if their conditions deteriorate. We therefore think the 75% rate is a conservative assumption. This assumption results in a projection of 8,700 players participating in the BAP.

52. We have been informed by plaintiffs' counsel that they have negotiated a rate of \$3,200 for each baseline examination through the BAP. Using this

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rate, we anticipate that the baseline examinations will cost \$28 million (\$25 million on a net present value basis).

53. Using plaintiffs' sample data, we also projected the number of players that would qualify for Level 1 (moderate cognitive impairment). We used the same overall process described above in generating current prevalence rates of the Qualifying Diagnoses within the population of approximately 1,500 plaintiffs in the sample data file. However, because Level 1 is a less severe condition, we placed players with fewer reported symptoms in Level 1. We assumed that 50% of players with at least five diagnosed symptoms, or who reported "Neuro-cognitive diagnosed", would be in Level 1. We also accounted for the fact that we expect players projected to develop Level 1.5, Level 2, Alzheimer's or Parkinson's in the future to first pass through Level 1. In total, we estimate that about 750 players will be diagnosed with Level 1 during the first ten years of the settlement—the period agreed to by the parties in the Settlement Agreement.

54. We have been instructed to assume that, for players diagnosed with a Level 1 diagnosis, the cost of further testing, treatment, and related drug therapy would not exceed \$35,000 per player. We assumed that every player that we project will be diagnosed with Level 1 impairment will be provided with the maximum amount of benefits, even though many players participating in the program are not likely to require benefits at this maximum level, which we consider another conservative assumption within the parameters we were given. The total payouts are expected to be \$27 million (\$20 million on a net present value basis).

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55. We have been informed by plaintiffs' counsel that they have negotiated administrative costs totaling \$7 million over the term of the BAP (\$6 million on a net present value basis), including the additional five-year period during which players may continue to receive supplemental benefits depending on the date of their diagnoses.

56. Our model projects costs of \$62 million to fund exams, provide supplemental benefits, and pay administrative costs over the term of the BAP. The funding requirements for the BAP contained in the Settlement Agreement call for an initial contribution in year one of \$35 million, plus additional funding to be added to the BAP whenever the balance of the fund dedicated to the BAP drops below \$10 million. We project that \$30 million in funding will need to be added to the initial \$35 million being deposited into the BAP fund over the ten-year period of the BAP. This results in total funding into the BAP of \$65 million, which has an NPV of \$56 million. At the end of the BAP's 10-year term and 5-year run out period for supplemental benefits, we project an ending balance of \$9 million that will never be used to cover the exams, supplemental benefits, and administrative costs of the BAP (per the funding requirement above). This unused balance of \$9 million, based on the cash flow of that \$9 million, has an NPV of \$5.5 million that will rollover into the MAF.

57. In addition, the Settlement Agreement sets aside \$75 million for the BAP overall. However, as noted above, we only project that \$65 million will need to be placed into the BAP fund over the term of the BAP. Thus, another \$10 million will be available at the end of the BAP and will rollover into the MAF. This unused allocation of \$10 million has an NPV of \$5.5 million.

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58. Therefore, we project the ending balance from the BAP fund (NPV \$5.5 million), plus the unused portion of the \$75 million allocated to the BAP (NPV of \$5.5 million) will combine to create an \$11 million total rollover into the MAF. The details of the cash flow associated with our calculations are provided in Exhibit [].

C. Cash Flow Analysis

59. In order to verify the monetary sufficiency of the Settlement on an “as needed” basis, we also conducted a cash flow analysis to determine the sufficiency of the fund on an annual basis. The funding schedule is set forth in Article XXIII of the Settlement Agreement. In addition to determining the sufficiency of the fund on an annual basis to generate necessary payouts, we further took account of the requirement that the MAF is required to maintain a balance of \$50 million at all times in accordance with section 23.4 of the Settlement Agreement.

60. Our model generally projects payments into the fund as of the beginning of each year based on the terms of the Settlement Agreement, while payments out of the funds are generally assumed to be paid mid-year based on the fact that players will be diagnosed and will submit claims throughout each annual year. Our model projects a large number of claims for individuals diagnosed prior to or within the first few years of the Settlement, and, as such, we conducted a more detailed analysis of the cash flow timing to determine whether any additional funding would be necessary over that period. Based on the administrative processes at the beginning of the Settlement, we assumed that the monetary awards to players during the first three years would be paid out on a monthly basis as follows:

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(a) Roughly half of the projected first-year claims will be for players who have a current, hard-coded Qualifying Diagnosis. These payments were assumed to be paid six months from the Effective Date of the Settlement.

(b) Roughly 30% of the projected first-year claims will be for players who are currently plaintiffs without a hard-coded Qualifying Diagnosis. These payments were assumed to be paid evenly over an 18-month period beginning six months from the settlement date.

(c) The remaining roughly 20% of the projected first-year claims will be for players who are not currently plaintiffs and do not have a hard-coded Qualifying Diagnosis. These payments were assumed to be paid evenly over a 24-month period beginning twelve months from the Effective Date of the Settlement.

(d) Estimated payments for years two and three were assumed to be paid evenly throughout the year.

61. Our cash flow analysis is attached as Exhibit E to this Report. Overall, we conclude that the MAF will be sufficiently funded on an annual basis to pay monetary awards to qualifying class members. Finally, we do not believe the MAF will need to be pre-funded at any point pursuant to the requirement that the NFL Parties maintain a minimum balance of \$50 million in the MAF.

V. CONCLUSIONS

62. We developed an actuarial model that accounts for the various factors arising out of the Settlement Agreement. In building this model, we made informed, conservative assumptions designed to determine the sufficiency of the Settlement and used statistical and actuarial methods to validate its sufficiency. The

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assumptions are reasonable and conservative individually and in aggregate. We took a conservative approach in developing our assumptions by seeking to err on the side of overstating the number of players who will develop Qualifying Diagnoses and by seeking to err on the side of projecting the development of the Qualifying Diagnoses at earlier ages. Thus, our goal was to project more monetary payments at higher values to retired players than may otherwise be expected to occur over the term of the Settlement. We did so in order to better test the sufficiency of the fund.

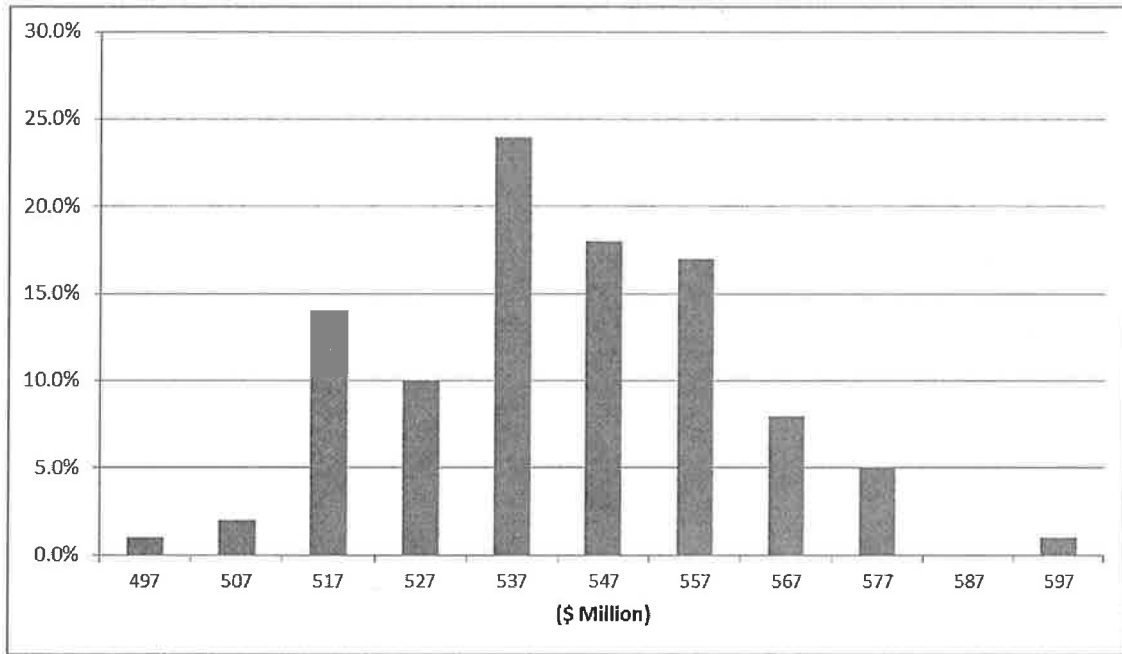
63. **BAP**. The \$75 million BAP Fund is sufficiently funded, and we expect \$11 million to be available on a net present value basis to further fund the MAF pursuant to Section 5.14 of the Settlement Agreement.

64. **MAF**. The Grid agreed to by the Parties in the Settlement Agreement will result in monetary awards to players totaling \$900 million on a nominal basis. This requires funding with a net present value of \$537 million to pay out the monetary awards that we anticipate will occur over the life of the Settlement. We believe that there is \$544 million available on a net present value basis between the funding dedicated to the MAF (\$533 million) and the rollover from the BAP (\$11 million) to pay the monetary awards. Thus, we project a cushion of \$7 million built into the Settlement—*without consideration of the \$37.5 million contingency fund*.

65. Our stochastic approach, based on the conservative assumptions described in this Report, generated a mean value of expected future benefits over the life of the Settlement of \$537 million, and a standard deviation of \$19 million. The summary of our results are as follows:

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Summary of Results (100 Runs)



66. As shown in the charts above and below, the distribution of the results approximates a normal distribution such that the 95% confidence interval around the mean is +/- \$37 million.²⁵ In other words, the chances of the total monetary awards over the life of the Settlement being outside of the confidence interval of \$500 million to \$574 million are five percent. And even if the actual monetary awards reach the top end of the confidence interval, *i.e.*, \$574 million, the \$37.5 million contingency fund would be available.

²⁵ The bell-curve distribution of results is consistent with statistical norms. In developing the model, we tested the distribution of results for 1,000 iterations to confirm that results are statistically normal. Further, the additional iterations had a *de minimus* impact on the mean and standard deviation of the results.

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Confidence Interval of Net Present Value of Payout

	Bottom (2.5%) Interval	Mean	Upper (2.5%) Interval
NPV of MAF	\$500,000,000	\$537,000,000	\$574,000,000
NPV of BAP	51,000,000	51,000,000	51,000,000
NPV of Admin Cost	6,000,000	6,000,000	6,000,000
NPV of Total Payout	557,000,000	594,000,000	631,000,000
NPV of Settlement Fund	601,000,000	601,000,000	601,000,000
Cushion/(Shortfall)	\$44,000,000	\$7,000,000	\$(30,000,000)

Ninety-five percent of potential outcomes are expected to fall within this range, meaning that only 2.5% are expected to fall below the bottom interval while 97.5% are expected to fall below the upper interval.

67. Overall, based on our model and the conservative assumptions described in our Report, we are confident that there is sufficient funding in the Settlement to compensate all eligible and qualified class members who will develop Qualifying Diagnoses during the 65-year term of the Settlement.

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APPENDIX A

Ettore Beghi et al., *The Epidemiology of ALS and the Role of Population-Based Registries*, 1762 *BIOCHIMICA ET BIOPHYSICA ACTA* 1150 (2006).

A. Chiò et al. *Global Epidemiology of Amyotrophic Lateral Sclerosis: A Systematic Review of the Published Literature*, 41 *NEUROEPIDEMIOLOGY* 118 (2013).

Simon Cronin et al., *Ethnic Variation in the Incidence of ALS: A Systematic Review*, 68 *NEUROLOGY* 1002 (2007).

E.R. Dorsey et al., *Projected Number of People with Parkinson Disease in the Most Populous Nations, 2005 through 2030*, 68 *NEUROLOGY* 385 (2007).

Jing Fang et al., *Prevalence of Stroke – United States, 2006-2010*, 61 *CENTERS FOR DISEASE CONTROL & PREVENTION: MORBIDITY & MORTALITY WEEKLY REPORT* 379 (2012).

Mark Faul et al., *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths 2002 – 2006* (Centers for Disease Control and Prevention, National Center for Injury Prevention and Control 2010).

Kevin M. Guskiewicz et al., *Association Between Recurrent Concussion and Late-Life Cognitive Impairment in Retired Professional Football Players*, 57 *NEUROSURGERY* 719 (2005).

Orla Hardiman, et al., *Clinical Diagnosis and Management of Amyotrophic Lateral Sclerosis*, 7 *NATURE REVIEWS NEUROLOGY* 639 (2011).

Michael D. Hurd et al., *Monetary Costs of Dementia in the United States*, 368 *NEW ENG. J. MED.* 1326 (2013).

Ellen S. O'Meara et al., *Head Injury and Risk of Alzheimer's Disease by Apolipoprotein E Genotype*, 146 *AM. J. OF EPIDEMIOLOGY* 373 (1997).

R.C. Petersen et al., *Practice Parameter: Early Detection of Dementia: Mild Cognitive Impairment (an Evidence-Based Review): Report of the Quality of Standards Subcommittee of the American Academy of Neurology*, 56 *NEUROLOGY* 1133 (2001).

B.L. Plassman et al., *Prevalence of Dementia in the United States; The Aging, Demographics, and Memory Study*, 29 *NEUROEPIDEMIOLOGY* 125 (2007).

B.L. Plassman et al., *Documented Head Injury in Early Adulthood and Risk of Alzheimer's Disease and Other Dementias*, 55 *NEUROLOGY* 1158 (2000).

M. Prince et al., *The Global Prevalence of Dementia: A Systematic Review and Metaanalysis*, 9 *THE JOURNAL OF THE ALZHEIMER'S ASSOCIATION* 63 (2013).

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Walter A. Rocca et al., *Trends in the Incidence and Prevalence of Alzheimer's Disease, Dementia, and Cognitive Impairment in the United States*, 7 ALZHEIMER'S & DEMENTIA 80 (2011).

U.S. Department of Health and Human Services, National Institutes of Health, Alzheimer's Disease Education & Referral (ADEAR) Center, *Alzheimer's Disease Fact Sheet* (NIH Publication No. 11-6423, Reprinted September 2012). Retrieved from http://www.nia.nih.gov/sites/default/files/alzheimers_disease_fact_sheet_0.pdf

David R. Weir et al., *National Football League Player Care Foundation: Study of Retired NFL Players*, University of Michigan Institute for Social Research (2009).

Allison Wright Willis et al., *Geographic and Ethnic Variation in Parkinson Disease: A Population-Based Study of US Medicare Beneficiaries*, 34 NEUROEPIDEMIOLOGY 143 (2010).

Karin Wirdefeldt et al., *Epidemiology and Etiology of Parkinson's Disease: A Review of the Evidence*, 26 EURO. J. EPIDEMIOLOGY S1 (2011).

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APPENDIX B

The underlying incidence rate assumptions within the model implicitly reflect an assumption regarding mortality. As an additional reasonability analysis, we considered the impact of an explicit mortality assumption in the form of a multiple decrement schedule in place of the progression methods and assumptions described in our Report.

As part of this analysis, we isolated the projected award payouts that are subject to the progression assumptions in the model (*i.e.*, the 25% of individuals assumed to progress from being asymptomatic to Level 1.5 or Level 2), grouping the liabilities by five-year age cohorts beginning at age 30 going through age 90.

Next, we selected sample lives for each starting age (*i.e.*, current age as of January 1, 2013) in five-year increments consistent with the five-year age cohorts. We then calculated the expected net present value of the projected award payouts for these sample lives using the same methods and assumptions used in the model, as well as under a multiple decrement schedule that reflects incidence and mortality rates for each age.¹

Finally, we calculated the ratio of the net present value under both modeling approaches for each sample life and multiplied the expected award payouts by that ratio for each cohort. Overall, the results of our analysis, when considering mortality explicitly, reduced the net present value of the expected award payouts by approximately \$7 million (roughly one-third of a standard deviation of the total net present value that is produced by the model as documented in this Report).

The incidence rates for the multiple decrement schedule were developed by adjusting the assumed incidence rates in the model to reflect the portion of the population that is expected to survive to each age. We conducted this analysis utilizing the RP2000 combined mortality table projected 20 years (same as used by the player's pension valuation actuary).

In order to further consider the potential impact of mortality, we then modeled an increased mortality improvement assumption using the RP2000 combined mortality table with generational projection using scale AA. The result of the improved mortality assumption is an increase to the net present value of approximately \$7 million when compared to results using the RP2000 combined table projected 20 years, thereby offsetting the \$7 million reduction for this alternative methodology. As such, this reasonability test confirms to us that our modeling is reasonable and that our methodology is appropriate.

¹ Analysis of the sample lives was limited to the progression related assumptions (*i.e.*, progression, incidence and mortality), as well as the award grid and inflation and discount rate assumptions.